A Trust-Aware Framework for Service Selection and Service Quality Review in e-Business Ecosystems

Submitted by
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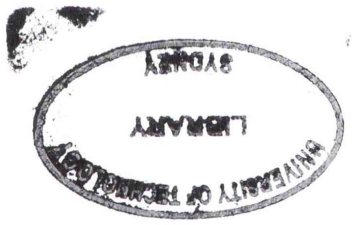
Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.



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Abstract

As e-Business has moved from a niche market to a decisive contributor for the success of most companies, some issues need to be solved in order to assist the continued success of e-Business. The challenge, to deploy fully autonomous business service agents which undertake transactions on behalf of their owners, often fails due to lack of trust in the agent and its decisions. Four aspects can overcome this challenge. Firstly, intelligent agents need to be equipped with self-adjusting reputation, trustworthiness and credibility evaluation mechanisms to assess the trustworthiness of potential counterparts prior to a business transaction. Secondly, such evaluation mechanisms must be transparent and easy to comprehend so agent owners develop trust in their agents' decisions. Thirdly, the calculations of an agent must be highly customisable so that the agent owner can apply his personal experiences and security requirements to govern the decision making process of the intelligent agent. And finally, agents must communicate via standardised and open protocols in order to facilitate interaction between services deployed across different architectures and technologies. This thesis proposes the *DEco Arch* framework which integrates behavioural trust element relationships into various decision making processes found in e-Business ecosystems. We apply fuzzy-logic based soft computing techniques to increase user confidence and therefore enhance the adoption of the proposed assessment and review methodologies. A proof-of-concept implementation of the *DEco Arch* framework has been developed to showcase the proposed concepts in a case study and to conduct empirical experiments to evaluate the robustness and practicability of the proposed methodologies.

List of Publications

[1] Schmidt, S., Steele, R. & Dillon, T., "Fuzzy Service Selection and Interaction Review in Distributed Electronic Markets", *4th International Conference on Trust, Privacy & Security in Digital Business*, Regensburg, Germany, 2007, pp. 237-245.

[2] Schmidt, S., Dillon, T., Steele, R. & Chang, E., "Trust and Reputation Ontologies for Electronic Business", *9th International Conference on Enterprise Information Systems*, Funchal, Madeira - Portugal, 2007, pp. 215-223.

[3] Schmidt, S., Chang, E., Dillon, T. & Steele, R., "Fuzzy Decision Support for Service Selection in E-Business Environments", in *IEEE Symposium on Computational Intelligence in Multi-Criteria Decision-Making* Honolulu, USA, 2007, pp. 374-381.

[4] Schmidt, S., Steele, R. & Dillon, "*DEco Arch*: Trust and Reputation Aware Service Brokering in Digital Ecosystems", in *IEEE International Conference on Digital Ecosystems and Technologies* Cairns, Australia, 2007, pp. 285-291.

[5] Schmidt, S., Steele, R., Dillon, T. "Fuzzy Trust Evaluation and Credibility Development in Multi-Agent Systems", *Applied Soft Computing,* vol. 7, pp. 492-505, 2006.

[6] Schmidt, S., Steele, R. & Dillon, "Towards Usage Policies for Fuzzy Inference Methodologies for Trust and QoS Assessment", in *International Conference on Computational Intelligence* Dortmund, Germany, 2006, pp. 263-274.

[7] Schmidt, S., Steele, R., Dillon, T. & Chang, E., "Fuzzy Service Quality Review in Service Oriented Architectures", in *IEEE International Conference on Fuzzy Systems* Vancouver, Canada, 2006, pp. 2247-2254.

[8] Schmidt, S., Steele, R., Dillon, T. & Chang, E. 2005b, "Building a Fuzzy Trust Network in Unsupervised Multi-agent Environments", in *International Workshop on Web Semantics* Agia Napa, Cyprus, 2005, pp. 816-825.

[9] Schmidt, S., Steele, R., Dillon, T. & Chang, E. 2005a, "Applying a Fuzzy Trust Model to E-Commerce Systems", in *Joint Conference on Artificial Intelligence* Sydney, Australia, 2005, pp. 318-329.